

Hearing Protective Devices

(Updated 24 April 2006)

Introduction

NAVOSH and BUMED policy regarding authorized hearing protection is described in the Navy Medical Department Hearing Conservation Program Procedures Manual (NEHC Tech Manual TM 6260.51.99-2 of Sept. 2004), which is available on the NEHC homepage. The basic “list” of approved hearing protective devices (HPDs) accompanies the hearing conservation chapters of NAVOSH Ashore and Afloat, and has been relatively constant for over 20 years. NEHC (acting on behalf of MED-M3B3) recommends very few additions to the list, as most hearing protection needs are readily met by the standard stock items. However, many new hearing protectors have come on the market in the last 20 years, and the below approval criteria offers needed flexibility.

The Navy does not currently have the ability to conduct routine testing of hearing protective devices, however, a listing of products that have been evaluated by DoD or other approved labs is located at the end of this section. There is an open policy for using noise muffs, therefore, any selection of noise muffs is acceptable, as long as it meets the attenuation requirements for the noise environment. However, if the list does not have an earplug that meets your needs, you may utilize the following protocol to evaluate a new product:

- Ensure that Industrial hygiene, Safety, and Occupational Audiology are cognizant of this need.
- Coordinate with the regional Occupational Audiologist to do a field test of the product.
- Purchase a small quantity of the product.
- Field test the product for comfort, durability, protectiveness (monitor STS rates on the subjects using this protector), and user acceptance.
- Record subjective results in the form of a survey.
- Send to the NEHC Audiology Team: an example of the desired product, a description of your unmet hearing protection needs, why you feel that the product offers benefit, and the results of your field test.

Current and Projected Methods for Determining and Labeling HPD Attenuation

There are basically two ways in which HPD attenuation can be measured. The first is termed Real Ear Attenuation at Threshold (REAT), which involves human listeners whose sound field thresholds for octave bands of sound are recorded in both a protected and un-protected mode. As an example, if the listener’s threshold for an octave band with a center frequency of 500 Hz drops from 5dB unprotected to 25dB protected, then the product is said to provide 20dB of attenuation at 500 Hz. The second method is termed Microphone in Real Ear (MIRE) and involves placing a probe microphone in the ear canal, medial to the protection being tested, and measuring the intensity of octave bands of sound in the canal compared to just outside the hearing protector. REAT is the preferred method, due primarily to variables stemming from microphone placement (location) in MIRE. While octave band REAT results are the most

accurate way to assess HPD adequacy/ desirability, a single-number value was desirable for convenience and marketing purposes – hence the Noise Reduction Rating or NRR.

Another factor involved in measuring HPD attenuation is the fitting method. Method A (ANSI S12.6-1984) is when the examiner (expertly) places the hearing protection on the subject. This method yields a higher NRR value and is often criticized for not correlating to a “real world” fitting by an actual user. Method B (ANSI S12.6-1997) is when the user (naively) places the hearing protection on him/herself (subject fit) after reading the instructions on the product package, with no examiner participation. **Do not interpret the lower NRR from subject fit (SF) testing as less effective than other protection devices that were measured with examiner fit.** Several methods have been used to calculate the NRR, and the Environmental Protection Agency is currently considering a major revision in the current NRR protocol.

Sound Guard Disposable Foam Earplugs (NSN 6515-00-137-6345) NRR = 28

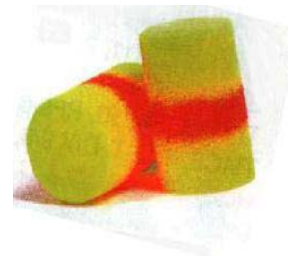
The Sound Guard foam earplug is the only universal fit disposable foam earplug which is authorized for order by DoD organizations because it is manufactured by New Dynamics, a sheltered workshop activity (see exception below). The attenuation provided is almost identical to the E.A.R. Classic plug. These orange and aqua green plugs have the value-added feature of indicating correct insertion. No orange should be visible if the necessary two-thirds insertion depth has been achieved.

Sound Guard plugs are not currently available in different sizes, they are essentially a "medium" size, despite the term "universal fit" and some users with either very small or large canals may benefit from the Aearo Superfit 30 or Superfit 33 foam plugs, respectively, as described below. This is currently the only permissible circumstance to purchase PVC foam earplugs elsewhere than the standard stocked foam plug.



Small And Large Sized Foam Earplugs Now Available Through GSA Superfit 30 (NRR=30) Superfit 33 (NRR=33)

The sized Superfit 30 (small) and Superfit 33 (large) Aearo foam earplugs are available from the GSA Advantage catalog. The SuperFit foam earplugs includes an orange-colored band in the center third of its length. Properly inserted, no orange will be visible – confirming that the necessary two-thirds insertion depth has been achieved. Remember that only the Sound Guard foam earplugs can be ordered for persons with average sized ear canals. A suggested distribution for stocking foam earplugs for adult men and women users is 25% small (SuperFit 30), 65% medium (Sound Guard), and 10% large sizes (SuperFit 33). The Superfit 30 & 33 are available under contract from this approved vendor:



Contract # GS-07F-9123D, Tactical & Survival Specialties, Inc. The plugs can be ordered from the on-line catalog at <http://www.GSAAdvantage.gov>. Go to the first SEARCH/BROWSE window and enter the part number below. They are sold in cases of 10 boxes (total 2000 pairs) or at higher unit cost for a box of 200 pairs. Specific catalog nomenclature appears below.

Small ears: Part # 1241-310-1009 EAR Classic SuperFit 30, NRR 30dB, uncorded in pillow packs, 2000 pairs per case. \$240.00 per case.

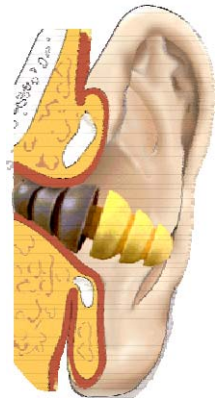
Large ears: Part # 1241-310-1008 EAR Classic SuperFit 33, NRR 33 dB, uncorded in pillow packs, 2000 pairs per case \$260.00 per case.

Single Flange Earplugs Are Going Away

The single flange earplugs are being discontinued and alternative products are being evaluated as replacements. See the Quattro below as one alternative. Single flange earplugs may continue to be used until existing stocks are depleted.

Combat Arms Ear Plug (NSN 6515-01-466-2710-double-sided) NRR=25 (non-baffled side)(NSN 6515-01-512-6072 yellow, single-sided)

The double-sided **Combat Arms Ear Plug** is based on the Aearo UltraFit triple flange plug and incorporates a baffle to reduce impact/impulse noise without significant attenuation of steady state (continuous) sounds. The single-sided (yellow) Combat Arms Ear Plug will better accommodate smaller ear canal sizes for use during impulse noise.



The basic attributes of this product are:

- In a combat situation, impulse protection is provided without significant compromise of steady state environmental sounds.
- In garrison situations (secured perimeter, as on board ship), the non-baffled side of the plug provides good protection against all noise.
- The extruding portion of the plug (whichever side is NOT in use) is colored to be either highly visible (optic yellow when the non-baffled plug in use), or a dull olive drab when in combat and the baffled plug is inserted for weapons fire.

A private distributor of this hearing protection is: Brock Sales Co., 1155 Providence Rd., Suite C, Brandon FL 33511 Ph# (813) 662-2251.

Quattro Earplug (NRR = 25)

The Elvex Quattro is a 4-flanged reusable earplug made from an ultra soft polymer. One size fits most. Ordering information:

Uncorded plugs: Stock # EP-401, NSN 6515-01-492-0443 (100 pairs/box)

Corded version: Stock # EP-411, NSN 6515-01-492-0458 (100 pairs/box)



Active Noise Reduction (ANR)

We are unaware of an industry standard to evaluate the protectiveness of Active Noise Cancellation (ANC) and Active Noise Reduction (ANR) products due to their dynamic attenuation properties. A good deal is known, however, about the types of environments and listener needs which lend themselves to this technology. Persons or commands considering such products are asked to contact the NEHC Occupational/Operational Audiology Team for discussion. **Shooters' muffs** do not technically fit in this category, but are included in this discussion in a generic sense due to their electronic circuitry. The Remington R2000 shooters muffs were evaluated via focused medical surveillance and user survey at Recruit Training Center Great Lakes. As a result of this user trial, this product was approved for Navy use in a small arms noise environment. Rationale centered on the effectiveness of passive attenuation properties of most earmuffs for protection from impulse noise. We encourage supervised field trials of these products, and will gladly work with you in this regard.

Open Policy on Noise Muff Hearing Protectors

NEHC has an open policy on use of noise muffs. While earplugs have a large variation in attenuation depending on how effectively the protector is worn, muffs have much less variability (i.e. less than 8 dB or so). Therefore, any noise muff that has the appropriate level of noise reduction for the work environment in which it is utilized is acceptable. Some examples of noise muffs that are currently available, and their noise reduction capabilities are listed at the end of this document.

Hearing Protectors Tested by DoD or other NEHC Approved Labs

The appendix provides a compilation of products that have been tested by an approved laboratory and may be considered for possible augmentation of standard stock items at Navy and Marine Corps activities. An approved lab is defined as one that meets general industry accreditation standards and is not affiliated with a manufacturer or product. Octave band Real Ear Attenuation at Threshold (REAT) results are provided, where available, as well as an NRR value. **NRR is provided using examiner fit methodology, unless labeled “(sf)” for subject fit**, which is a more conservative estimate of a protector's attenuation.

As a generalization, examiner fitted NRR values represent maximum available attenuation, while subject fitted protectors might be termed “real world”. In reviewing data for each protector, note that some provide significantly more protection than others, and that subject fit protectors will typically score several dB less attenuation than examiner fit, precluding direct comparison. It has been recommended that de-rating examiner fitted earplug NRRs by 50% to approximate real world benefit, however, subject fit NRRs should not be de-rated. While **more** is not always **better** with respect to hearing protectors, both the octave band and single figure attenuation value (NRR) recorded for each product should be compared with the anticipated noise environment in estimating the adequacy of the product to protect exposed personnel.

Finally, appearance on this list is NOT an endorsement of better than average performance.

Performance data has been extracted from USAF data (Air Force Research Laboratory, Wright-Patterson AFB), Army data (from the Aeromedical Research Laboratory, Fort Rucker), and other approved labs. The data do not constitute an endorsement of any product by any military Service.

The NEHC Audiology/Hearing Conservation Team

Contact us at audiology@nehc.mar.med.navy.mil

Appendix: Tested Hearing Protectors

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Aearo/Peltor E-A-R UltraFit	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	28	27	27	29	32		32		40	15
Standard Deviation	7	7	7	8	5		7		6	
Flents Quiet! Please	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	19	21	23	25	30	37	38	39	40	11
Standard Deviation	7.0	8.0	8.0	7.0	4.0	6.0	5.0	6.0	5.0	

Flents Silaflex(silicone)	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	21	21	19	28	42	44	41	40	37	16
Standard Deviation	4.5	4.1	5.0	5.4	3.3	4.7	4.9	3.1	6.4	
NSN 6515-00-135-2612 (24 pr)										
NSN 6515-00-133-5416 (100 pr)										
Howard Leight Max 1	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	29	30	32	30	36	43	46	47	47	18
Standard Deviation	8.0	8.1	7.6	7.2	4.0	4.5	4.9	3.3	3.8	
NSN 6515-01-329-4700										
New Dynamics Sound Guard (green)	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	31	35	37	37	33		42		45	25
Standard Deviation	7	7	7	6	4		4		6	
Custom Plugs										
CEP Inc. CEP199-ESTP	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	27	26	30	32	33		39		42	21
Standard Deviation	4	4	4	6	5		4		4	
Westone Labs ACCES Aviation Ground Crew	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	33	32	34	35	37		42		46	24
Standard Deviation	6	6	6	5	5		3		4	

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Bilsom Viking V2	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	7	10	17	28	30	35	36	36	34	13 (sf)
Standard Deviation	3.8	3.5	2.7	3.4	3.1	3.9	4.2	4.9	6.9	

Bilsom Viking V3	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	15	21	30	34	32	36	41	41	40	22 (sf)
Standard Deviation	3.1	4.2	3.4	3.7	3.5	2.9	3.5	4.7	5.7	

Howard Leight QM 24+	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	10	13	18	28	27	29	29	32	33	10 (sf)
Standard Deviation	5.7	6.1	5.0	4.7	3.9	4.2	3.0	5.8	5.9	

Blue Point GA 3000	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	16	18	28	39	34	33	33	34	32	19
Standard Deviation	4.4	4.4	4.1	4.4	3.1	2.5	3.2	4.1	6.2	

Cabot 1720	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	7	14	21	30	31	32	34	35	34	13
Standard Deviation	5.4	4.5	5.0	5.0	3.5	3.9	3.6	3.7	5.0	

David-Clark 310	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	12	18	27	34	30	39	37	37	36	17
Standard Deviation	3.9	3.6	5.3	5.9	5.3	4.1	4.1	3.6	3.2	

E-A-R 1000	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	8	14	24	28	24	28	26	25	27	14 (sf)
Standard Deviation	3.3	2.9	3.6	4.5	2.5	2.9	4.6	5.3	5.0	

E-A-R 820	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	7	9	18	27	27	32	32	32	30	10 (sf)
Standard Deviation	3.9	4.3	4.9	4.4	4.4	3.9	4.5	6.3	7.5	

E-A-R 9000	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	9	15	25	25	23	26	25	23	25	14 (sf)
Standard Deviation	3.5	2.5	2.5	5.9	2.9	2.4	2.0	3.1	3.1	

Gentex Wolf Ear	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	8	14	21	22	20	30	35	35	36	10 (sf)
Standard Deviation	3.4	3.7	5.1	4.0	5.0	6.4	6.7	5.4	5.8	

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Tasco Sound Shield 2900	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	14	20	28	38	35	39	38	36	35	19
Standard Deviation	3.0	3.6	6.7	3.9	5.5	5.2	6.1	4.0	3.4	

Vallen Pro-Max 1	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	15	21	30	35	33	34	35	36	33	21 (sf)
Standard Deviation	3.9	4.4	4.3	3.8	4.0	3.3	2.4	3.9	6.3	

Communication Headsets	Octave Band Attenuation									NRR
Astrocom 81349MIL-H-87819	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	16	20	26	41	42	36	33	32	32	19
Standard Deviation	4.5	3.7	5.3	7.0	4.8	4.1	5.6	4.2	5.5	
NSN 5965-01-204-8505										
Astrocom H157A	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	10	12	16	22	27	35	38	38	38	11
Standard Deviation	5.1	2.8	4.6	4.3	4.5	5.2	4.5	5.7	8.5	
NSN 5965-01-128-1410										
David Clark H10-76	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	14	20	20	21	33	37	38	34	31	14
Standard Deviation	4.0	3.7	3.1	4.9	3.4	4.3	4.6	7.3	7.4	
NSN 5965-01-390-9240										
David Clark H133C	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	22	24	31	26	27	29	37	34	34	17(sf)
Standard Deviation	5.5	5.6	5.3	3.2	5.4	3.9	4.9	2	3.9	
Peltor Lite-Com	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	12	19	24	34	30	33	36	35	35	20(sf)
Standard Deviation	3.1	2.7	2.4	3.4	3.8	2.8	2.7	3.9	3.2	

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Roanwell 495-622001-604	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	12	18	23	22	23	29	31	32	32	13(sf)
Standard Deviation	6.9	5.2	5.2	3.4	3.2	3.3	3.9	5.9	5.8	
Wire-Com De-Icing	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	13	15	26	32	30	34	38	40	38	20(sf)
Standard Deviation	3.8	1.7	3.5	3.6	3.6	2.5	2.8	4.0	4.0	

Helmet	Octave Band Attenuation									NRR
HGU-26/P With MX 8376/AR ear cups	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	7	6	14	22	33	43	44	40	37	6
Standard Deviation	5.1	5.6	5.0	4.4	6.5	5.7	5.7	11	10.7	
HGU-26/P With Pillow Block Earpad	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	2	6	10	13	20	28	30	37	35	2
Standard Deviation	5.8	5.4	5.2	5.1	7.2	7.8	9.5	7.4	5.5	
HGU-53/P, Gentex	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	15	8	19	26	39	46	50	54	53	10
Standard Deviation	4.4	2.4	6.9	7.8	5.7	4.9	4.2	5.3	6.3	
HGU-55/P, Gentex	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	10	5	19	31	44	46	49	50	50	12
Standard Deviation	4.1	2.8	3.1	5.1	3.4	5.0	7.3	6.4	6.8	

SPH-4B, Gentex	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	14	13	24	37	38	40	40	45	43	20
Standard Deviation	2.8	2.2	2.2	5.4	2.6	4.0	4.3	5.0	4.8	

Plug and Muff	Octave Band Attenuation									NRR
E-A-R Plugs/Blue Point GA-3000	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	31	30	37	39	34	44	46	46	45	20
Standard Deviation	8.4	8.2	8.4	9.4	5.4	6.4	9.3	6.4	5.9	
E-A-R Plugs/ H. Leight Thunder T3	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	33	38	47	44	36	47	50	46	45	27
Standard Deviation	5.6	9.0	8.6	5.8	5.2	6.2	6.0	5.2	4.2	
E-A-R Plugs/ Peltor Twin Cup Muff	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	31	32	43	42	38	50	50	50	48	26
Standard Deviation	6.7	7.6	8.2	6.3	5.2	6.3	5.8	3.4	3.3	
E-A-R Plugs/ Safety Direct RBW-71 Muff	125	250	500	1K	2K	3K	4K	6K	8K	NRR
Mean Attenuation	31	37	44	41	38	48	49	48	46	28
Standard Deviation	6.5	6.3	8.2	5.3	5.4	6.0	4.1	3.2	4.4	